

Spot Safety Project Evaluation

Project Log # 200406238

Spot Safety Project # 04-97-203

**Spot Safety Project Evaluation, of the Flashing Traffic Signal Installation at the Intersection of
NC 210 and SR 1309-Old Fairground Road in Johnston County**

Documents Prepared By:

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08/09/2004
Date

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 04-97-203 – The Intersection of NC 210 and SR 1309-Old Fairground Church Road in Johnston County

Introduction

In an attempt to assess the safety of our roads, the Safety Evaluation Section of the Traffic Safety Systems Management Unit has evaluated the above project. The methodologies used in this evaluation offer various philosophies and ideas, in an effort to provide objective countermeasure crash reduction results. A naive before and after analysis and a linear regression before and after analysis of the treatment versus comparison data have been completed to measure the effectiveness of the spot safety improvement. This information is provided to you so the benefit or lack of benefit for this type of project can be recognized and utilized for future projects.

Project Information and Background from the Project File Folder

The spot safety project improvement countermeasure chosen for the subject location was the installation of a flashing traffic signal. NC 210 is a two-lane facility with no left turn lanes at the intersection with SR 1309-Old Fairground Church Road. SR 1309-Old Fairground Church Road is also a two-lane facility with no left turn lanes. NC 210 and SR 1309-Old Fairground Church Road both have a speed limit of 55 mph. The intersection is controlled by stop signs on SR 1309. Angle and Left-Turn crashes continued to occur at the intersection after previous countermeasures were implemented (including stop bars painted, oversized stop signs installed, and stop signs flagged). The engineer requesting the countermeasures felt motorists were having difficulty identifying the existing traffic control and that a flashing traffic signal would better identify it. The initial crash analysis for this location was completed from September 1, 1990 through August 31, 1996 with a total of 21 reported crashes. There were fourteen Angle crashes, three Left-Turn crashes, three Rear-End crashes, and one Random crash. Five class A injuries, eight class B injuries, and sixteen class C injuries resulted from these accidents. The final completion date for the flashing traffic signal installation at the subject intersection was on April 25, 1997.

Naive Before and After Analysis

After reviewing the spot safety project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from March 1, 1997 through June 30, 1997. The before period consisted of reported crashes from December 1, 1990 through February 28, 1997 (6 Years, 3 Months) and the after period consisted of reported crashes from July 1, 1997 through September 30, 2003 (6 Years, 3 Months). The ending date for this analysis was determined by the available crash data at the time the crash analysis was completed.

The analysis also consisted of two different sets of data, the treatment and the comparison data. The treatment data consisted of all crashes within 150 feet of the subject intersection. The comparison data consisted of all crashes within a 150 feet Y-line on NC 210, from the Harnett County Line to 0.05 miles west of SR 1309-Old Fairground Road. The following data table depicts the Naive Before and After Analysis for the above information. Please note that Frontal Impact Crashes were the target crashes for the applied countermeasure. These crash types considered are as follows: Left turn, same roadway; Left turn, different roadways; Right turn, same roadway; Right turn, different roadways; Head on; and Angle.

Treatment Information

	Before	After	Percent Reduction (-)/ Percent Increase (+)	Statistically* Significant?
Total Crashes	21	30	42.9	No
Total Severity Index	14.65	4.45	- 69.6	Yes
Frontal Impact Crashes	17	20	17.6	No
Frontal Severity Index	17.42	4.33	- 75.1	Yes
Volume	4300	6500	51.2	Yes

Comparison Information

	Before	After	Percent Reduction (-)/ Percent Increase (+)	Statistically* Significant?
Total Crashes	61	83	36.1	Yes
Total Severity Index	11.61	6.77	- 41.7	No
Frontal Impact Crashes	14	15	7.1	No
Frontal Severity Index	9.59	16.04	67.3	No
Volume	2700	3800	40.7	Yes

Odds Ratio: Treatment versus Comparison

	Before	After	Percent Reduction (-)/ Percent Increase (+)	Statistically* Significant?
Treatment Total Crashes	21	30	---	
Comparison Total Crashes	61	83	5.0 %	No

* Statistical significance tested at the 80% confidence interval using the *T Test* methodology.

The naive before and after analysis at the treatment location resulted in a 42.9 percent increase in Total Crashes, a 17.6 percent increase in Frontal Impact Crashes, and a 51.2 percent increase in Average Daily Traffic (ADT). The comparison locations resulted in a 36.1 percent increase in Total Crashes, a 7.1 percent increase in Frontal Impact Crashes, and a 40.7 percent increase in ADT. The before period ADT year was 1994 and the after period ADT year was 2000.

The Odds Ratio is used as another means of calculating the treatment effect. The total crashes in the before and after period from the Comparison Strip are used to calculate the percent reduction in total crashes for the Treatment Intersection. As shown in the table below, using the Odds Ratio calculation, there is a 5.0 percent increase in Treatment Intersection crashes.

Linear Regression Before and After Analysis (Treatment versus Comparison Data)

Crash data was completed and analyzed from January 1, 1990 through September 30, 2003 for both the treatment and comparison data areas. This yearly crash data was then reduced from yearly data to crashes per month. The data was then placed into a graphical format for treatment and comparison data areas separated into before and after time periods for both Total Crashes and Frontal Impact Crashes. The before period consisted of crash data from January 1, 1990 through February 28, 1997 (7 Years, 2 Months) and the after period consisted of crash data from July 1, 1997 through September 30, 2003 (6 Years, 3 Months).

The linear regression of both the treatment and comparison data area was plotted for the before period for both the Total Crash and Frontal Impact Crash categories. These categories demonstrated similar slope comparisons within the linear regression for both the treatment and comparison data. Since the slopes were similar, it is reasonable to assume the treatment and comparison data sets are adequate for predicting crashes within the after period based on the likeness of data sets in the before period. The linear regression of both the treatment and comparison data area was also plotted for the after period for both the Total Crash and Frontal Impact Crash categories. The slopes of this linear regression analyses were also used to determine predicted crashes in the after period.

The *treatment predicted* crashes were found by projecting the linear regression equation in the before period of the treatment data to the beginning month of the *treatment actual* after period. The *treatment actual* after period within this analysis is from July 1, 1997 through September 30, 2003 (6 Years, 3 Months). The first prediction data comparison was to compare the linear regression equation crash results of the *treatment predicted* after period data versus the *treatment actual* after period data. The difference between these two linear equations resulted in the number of crashes for the first prediction method. The second prediction data comparison was to compare the linear regression equation crash results of the *comparison predicted* after period data versus the *treatment actual* after period data. The difference between these two linear equations resulted in the number of crashes for the second prediction method.

			Percent Reduction (-)/ Percent Increase (+)	Statistically* Significant?
<u>Treatment Predicted versus Treatment Actual</u>				
Total Crashes	44	30	- 31.8	Yes
Frontal Impact Crashes	32	20	- 37.5	Yes
<u>Comparison Predicted versus Treatment Actual</u>				
Total Crashes	56	30	- 46.4	Yes
Frontal Impact Crashes	41	20	- 51.2	Yes

* Statistical significance tested at the 80% confidence interval using the *T Test* methodology.

The linear regression before and after analysis of the treatment versus comparison data resulted in the following crash reduction factors for the two comparisons analyzed. The *Treatment Predicted versus Treatment Actual* resulted in a 31.8 percent decrease in Total Crashes and a 37.5 percent decrease in Frontal Impact Crashes at the treatment location. This comparison methodology is another type of naive before and after analysis using the assumption that the crashes in the before period would continue on the same linear regression as the crashes at the treatment location in the before period, if nothing had been done. The *Comparison Predicted versus Treatment Actual* resulted in a 46.4 percent decrease in Total Crashes and a 51.2 percent decrease in Frontal Impact Crashes at the treatment location. This comparison methodology analyzes the *Treatment Actual* crashes compared to the *Comparison Predicted* crashes using the linear regression from the comparison area after period projected onto the treatment area. The method reflects crash trends in the comparison area to the treatment area.

Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 42.9 percent increase in Total Crashes and a 17.6 percent increase in Frontal Impact Crashes. The treatment area linear regression analysis involving the comparison of treatment predicted after data versus treatment actual after data resulted in a 31.8 percent decrease in Total Crashes and a 37.5 percent decrease in Frontal Impact Crashes. The comparison area linear regression analysis involving the comparison of comparison predicted after data versus treatment actual after data resulted in a 46.4 percent decrease in Total Crashes and a 51.2 percent decrease in Frontal Impact Crashes. Using the Odds Ratio to calculate the treatment effect resulted in a 5.0 percent increase in Total Crashes at the Treatment Intersection. The Severity Index for Total Crashes and Frontal Impact Crashes at the treatment intersection decreased by 69.6 percent and 75.1 percent, respectively.

The summary results above demonstrate that even though the treatment location appears to have an increase in Total Crashes and Frontal Impact Crashes from the before to the after period the crash increase may not be accurate when comparing the treatment location to the surrounding comparison section or to the treatment predicted data. There is actually a significant crash reduction when comparing the treatment actual after data to either the treatment predicted after data or comparison predicted data. The treatment location predicted data demonstrates that the treatment location was

predicted to have a larger number of Total Crashes and Frontal Impact Crashes occur in the after period had the treatment not been installed.

As previously mentioned, the flashing traffic signal was installed to help motorists better identify the existing traffic control. However, analysis of the crash data in the after period reveals that only 2 out of the 30 crashes (6.7 percent) at the treatment intersection were caused by a vehicle running through the stop signs located on SR 1309-Old Fairground Road. The accident problem does not appear to be caused by a lack of recognizing the stop condition.

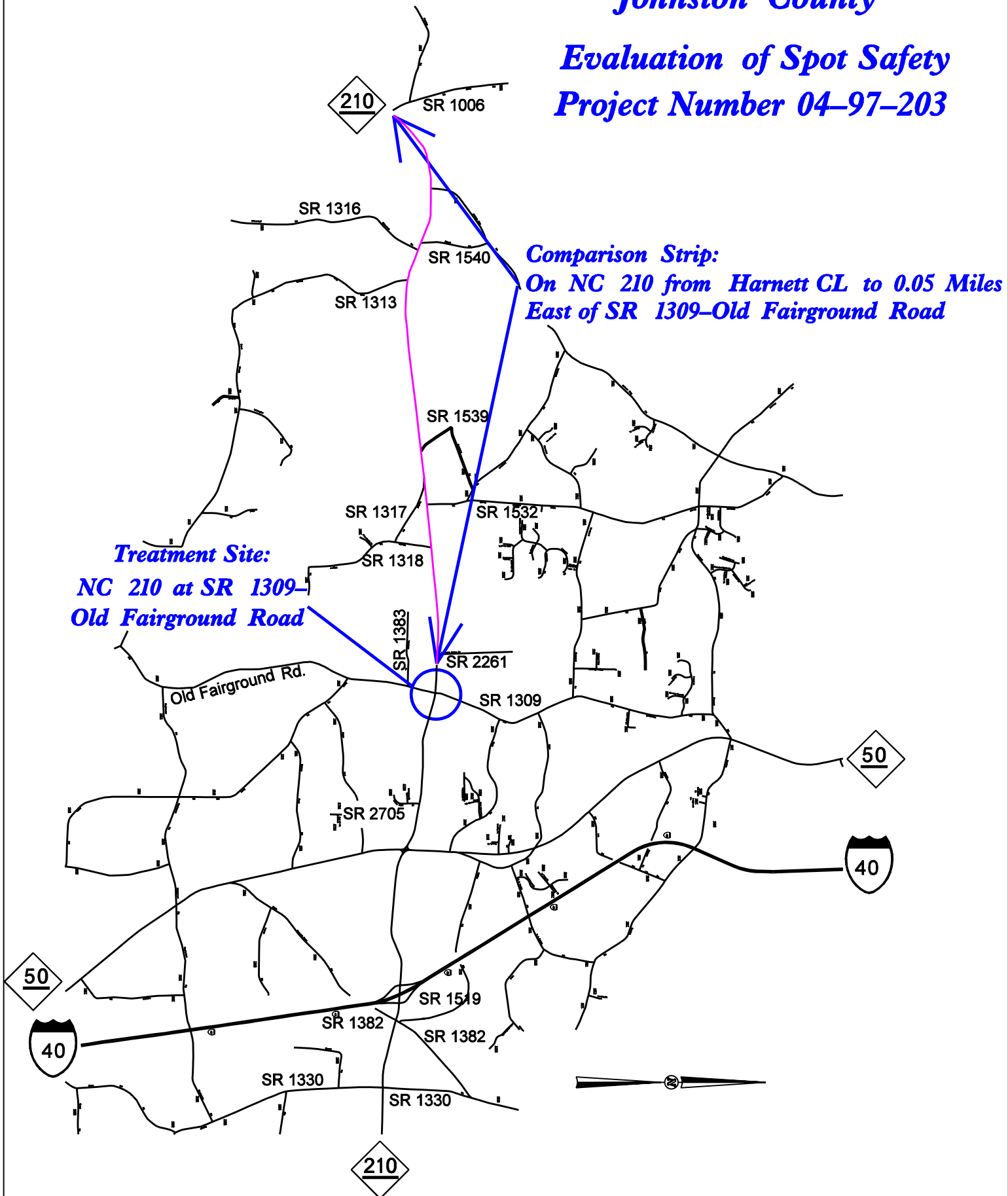
The large number of Angle crashes may be occurring because motorists on SR 1309-Old Fairground are unable to find acceptable gaps in traffic. The treatment intersection ADT increased by 51.2% from the before period to the after period. Further investigation of the after period crash data reveals that 26 out of the 30 crashes (86.7 percent) at the treatment intersection occurred between the hours of 5 a.m. to 10 a.m. and 2 p.m. to 7 p.m. In addition, 28 after period crashes occurred between the weekdays of Monday through Friday. It appears that an increase in commuter traffic has created a problem for traffic crossing NC 210 at SR 1309-Old Fairground Road.

Please see the attached *Treatment Site Location Photos*. Photos are provided for each leg of the treatment intersection. Also, photos are attached which show the gas station entrances located in the southeast quadrant of the intersection. These access points are located extremely close to the treatment intersection. Vehicles using the entrance on NC 210 are potentially causing site distance problems to traffic on SR 1309-Old Fairground Road. It is suggested that an access review be completed on the gas station entrance on NC 210 for the feasibility of closure and to evaluate potential site distance problems that may exist. Vehicles may still access NC 210 from the entrance located on SR 1309-Old Fairground Road.

The countermeasure crash reduction for Total Crashes at the subject intersection can be in the range of a 46.4 percent decrease to a 42.9 percent increase in crashes. The countermeasure crash reduction for Frontal Impact Crashes at the subject intersection can be in the range of a 51.2 percent decrease to a 17.6 percent increase in crashes. As the Safety Evaluation Section completes additional spot safety reviews for this type of countermeasure, we will be able to provide objective and definite information regarding actual crash reduction factors.

***Location Map,
Johnson Crossroads,
Johnston County***

***Evaluation of Spot Safety
Project Number 04-97-203***



Treatment Site Location Photos (Taken on July 1, 2004)



Looking North at the intersection of NC 210 and SR 1309/ Old Fairground Road



Looking South at the intersection of NC 210 and SR 1309/ Old Fairground Road

Treatment Site Location Photos (Taken on July 1, 2004)



Looking East at the intersection of NC 210 and SR 1309/ Old Fairground Road



Looking West at the intersection of NC 210 and SR 1309/ Old Fairground Road

Treatment Site Location Photos (Taken on July 1, 2004)



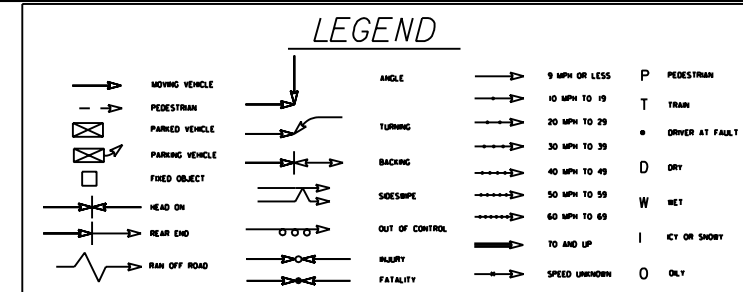
Looking North, notice the gas station entrance onto SR 1309/Old Fairground Road



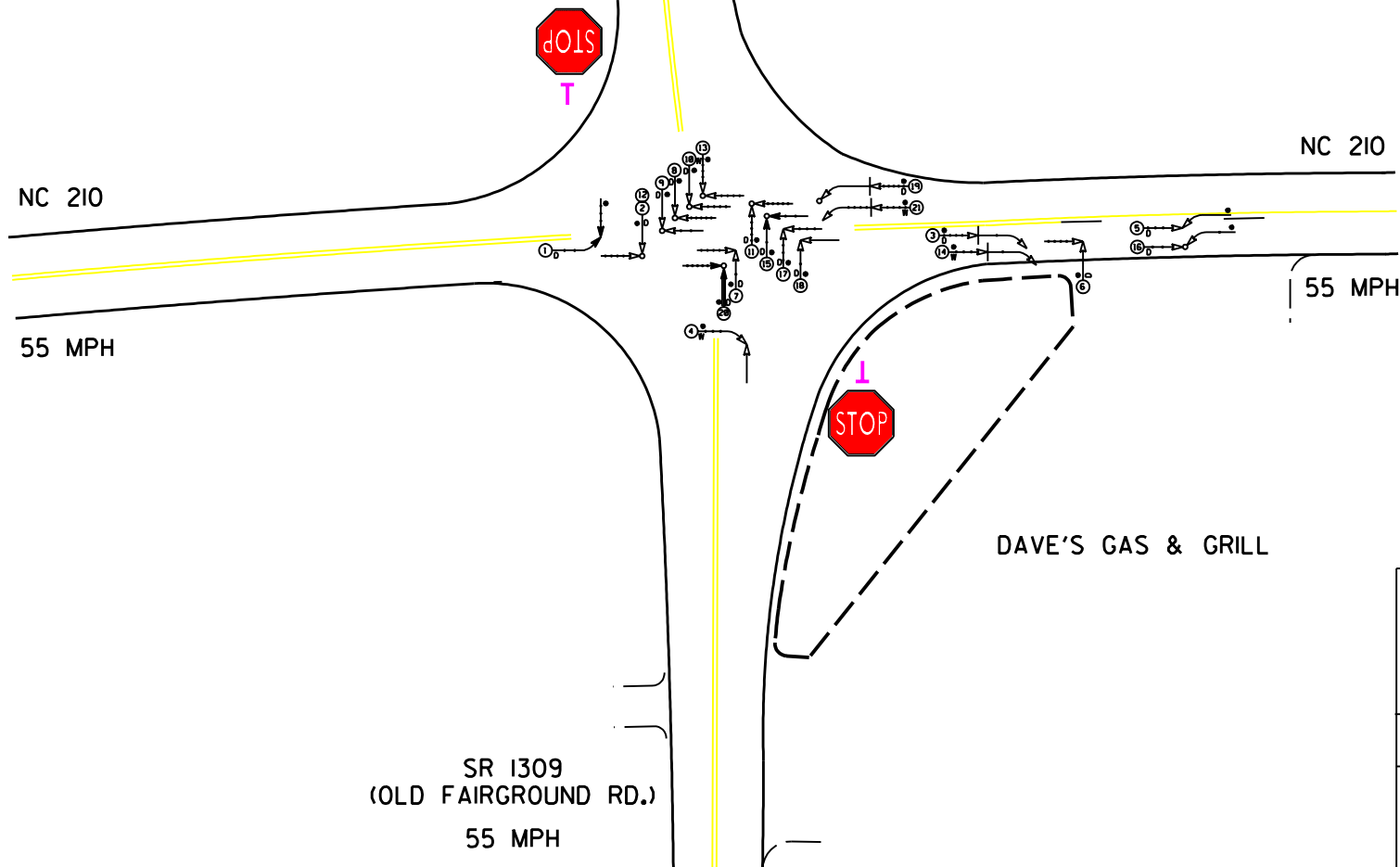
Looking West, notice the gas station entrance onto NC 210



SR 1309
(OLD FAIRGROUND RD.)
55 MPH



Treatment Site - TotalCrashes - Before Period
DECEMBER 1, 1990 THROUGH FEBRUARY 28, 1997 (6 Years, 3 Months)



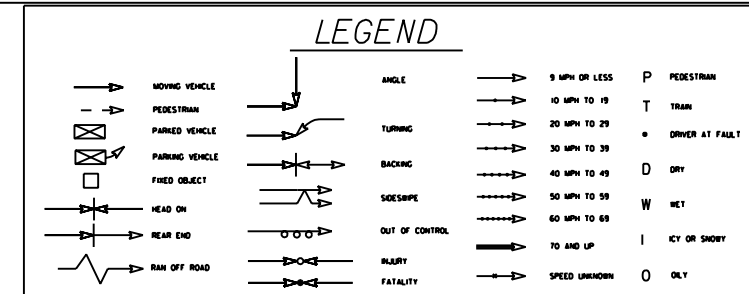
TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION: 4	AREA: 1
	STUDY PERIOD: 12/1/1990-2/28/1997	
	DISTANCE: 1/4 MILE - 1/2 MILE	
ANALYSIS PREPARED BY: C. GOODRICH		
ANALYSIS CHECKED BY: C. GOODRICH		
DIAGRAM PREPARED BY: C. GOODRICH		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: JULY, 2004		
LOG NUMBER:		

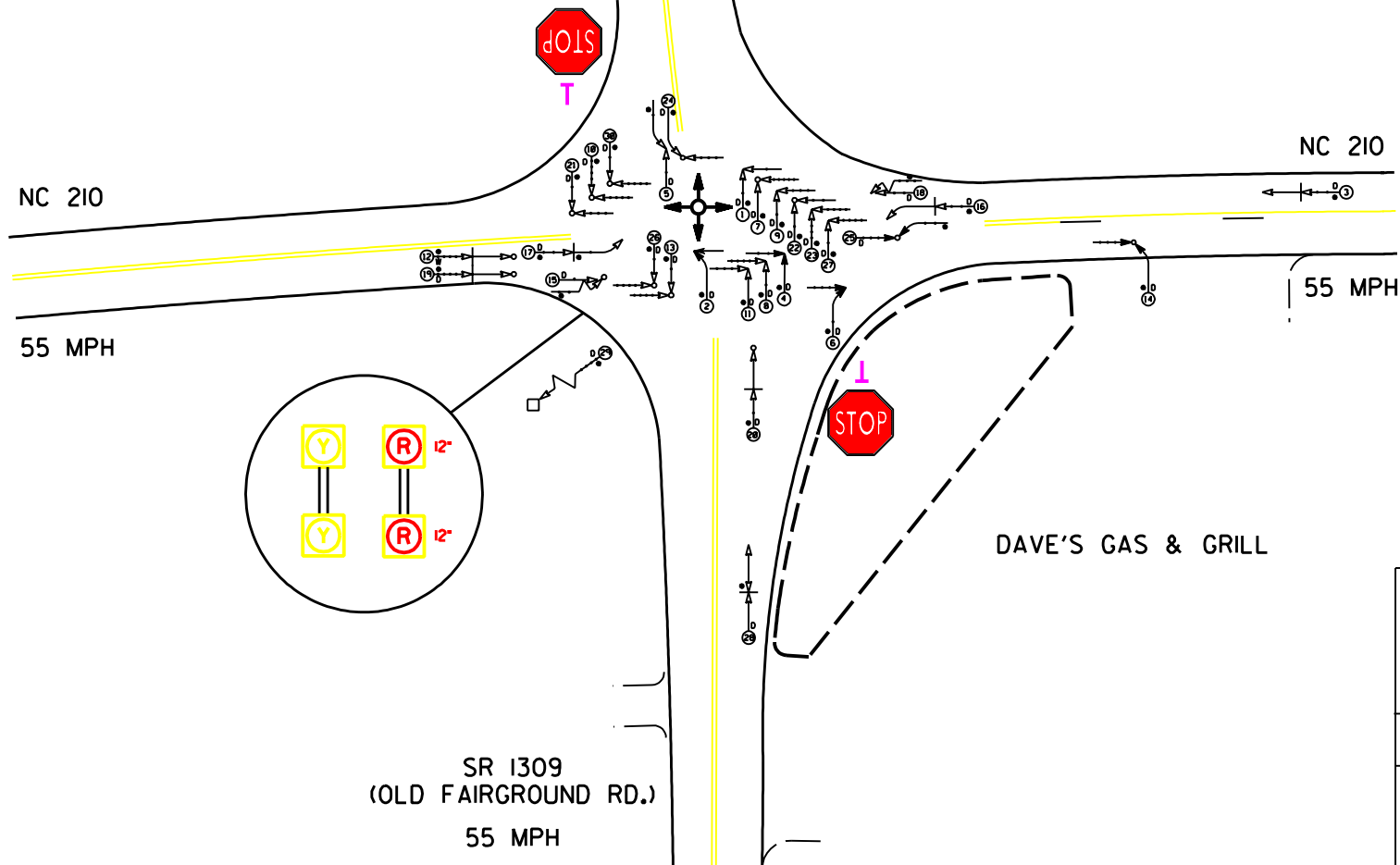
N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH



SR 1309
(OLD FAIRGROUND RD.)
55 MPH



Treatment Site - TotalCrashes - After Period
JULY 1, 1997 THROUGH SEPTEMBER 30, 2003 (6 Years, 3 Months)



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

	COLLISION DIAGRAM	
	DIVISION 4	AREA 1
	STUDY PERIOD: 7/1/1997-9/30/2003	
	DISTANCE: T-LINE + 150 FT	
	ANALYSIS PREPARED BY: C GOODRICH	
ANALYSIS CHECKED BY:		
DIAGRAM PREPARED BY: C GOODRICH		
DIAGRAM REVIEWED BY:		
SCALE: NOT TO SCALE		
DATE: JULY, 2004		
LOG NUMBER:		

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY
SYSTEMS BRANCH